METHOD FOR MANAGING INFORMATION
AND RENDERING DISCOUNTS

TECHNICAL FIELD

5   The present invention relates to a method for managing information and rendering discounts in a billing system.

BACKGROUND ART

In many lines of business, and particularly in the telecommunications industries, managing information for a large number of customers may become quite complicated. Further, customer bills are often adjusted by various discounts.

10   Applying the discounts to the bills, particularly in the telecommunications industries, may quickly become complicated due to the large number of customers and the large amounts of data for each customer during a particular billing period.

In an existing method for rendering discounts, a complex application specific software package is developed to render discounts in a particular billing

15   system having a highly defined structure. The application specific software package is developed for a single company to use for their customers, and is tailored to meet the specific needs of that company. As such, developing a discount rendering software package is expensive, and takes a lot of time. As such, it is not feasible to change the way in which discounts are rendered very often, because the software

20   package is so application specific that it is sometimes necessary to develop an entire new application specific software package in order to revise the discount rendering technique. Further, because the package generally is implemented for use with a highly defined billing structure, these applications are generally not usable by others than the company that the particular package is designed for.

For the foregoing reasons, there is a need for a method for managing information and rendering discounts in a billing system that is more easily modified, and may be ported to different platforms without excessive difficulties.

DISCLOSURE OF INVENTION

5   It is, therefore, an object of the present invention to provide a method for managing information and rendering discounts in a billing system that utilizes a rule-based engine configured to accumulate data and render discounts.

In carrying out the above object, a method for managing information and rendering discounts in a billing system is provided. The method comprises

10   receiving a record including data, establishing a rule-based accumulation engine, and processing the record. The record is processed with the accumulation engine to accumulate the data in a plurality of pre-determined target accumulators. The method further comprises establishing a rule-based discount engine, and processing the plurality of target accumulators. The plurality of target accumulators are

15   processed with the discount engine to render discounts applicable to the customer.

In a preferred embodiment, the record has a record type and establishing the accumulation engine further comprises establishing a rule table that directs the accumulation engine based on the record type. Further, preferably, at least one rule is established for processing a record by performing a sequence of

20   operations to the data, with the rules table directing the accumulation engine to apply the at least one rule when dictated by the record type. Still further, preferably, at least one function is established for processing a record, with the rules table directing the accumulation engine to apply the at least one function when dictated by the record type. Even further, preferably, the rules table directs the accumulation engine

25   to pass the data directly to a target accumulator when dictated by the record type.

In a preferred embodiment, the record includes at least one source field, and receiving the record further comprises assigning a logical name to a source field. The accumulation engine processes is the record using the logical name. As

such, the accumulation and discount engines are not limited by the format of incoming data, because logical names are assigned to incoming data source fields to place the data in a standard format for the rules-based engines.

In one implementation, establishing the discount engine further comprises establishing at least one rule for processing the record to evaluate discount qualification and at least one rule for processing the record to evaluate discount applications. Further, in one implementation, establishing the discount engine further comprises establishing at least one simple rule for processing the record. Still further, establishing the discount engine preferably further comprises establishing at least one compound rule for processing the record. The at least one compound rule is composed of a plurality of simple rules, with the discount engine applying the compound rule by recursively applying simple rules.

Further, in carrying out the present invention, a discount system for managing information and rendering discounts in a billing system is provided. The system comprises a rule-based engine configured to receive a customer record including data, and process the record to accumulate the data in a plurality of pre-determined target accumulators. The rule-based engine is further configured to process the plurality of target accumulators to render discounts applicable to the customer.

Still further, in carrying out the present invention, a computer readable storage medium having information stored thereon representing instructions executable by a computer to manage information and render discounts in a billing system is provided. The computer readable storage medium further comprises instructions for receiving a customer record including data, instructions for establishing a rule-based accumulation engine, and instructions for processing the record with the accumulation engine to accumulate the data in a plurality of predetermined target accumulators. The computer readable storage medium further comprises instructions for establishing a rule-based discount engine, and instructions for processing the plurality of target accumulators with the discount engine to render discounts applicable to the customer.

In a preferred embodiment, the computer readable storage medium further comprises instructions for establishing a rules table and rules and functions that are applied as directed by the rules table as dictated by record type. Further, preferably, logical names are assigned to source fields. Still further, the computer readable storage medium further comprises instructions for evaluating discount qualification, and evaluating discount applications using simple rules and compound rules that are performed by recursive application simple rules.

The advantages associated with embodiments of the present invention are numerous. For example, embodiments of the present invention provide a method, system, and computer instructions for managing information and rendering discounts in a billing system that utilizes a rule-based engine to process the billing information. Advantageously, using a rule-based approach simplifies steps involved in changing the way discounts are applied and adding additional functionality. Further, preferred embodiments assign logical names to source data fields so that the rule-based engine or engines be ported to many different billing platforms without excessive difficulties. Advantageously, the present invention provides a rule-based engine for billing applications with far more flexibility than the non-rule-based application specific programs in the prior art.

The above object and other objects, features, and advantages of the present invention are readily apparent from the following detailed description of the best mode for carrying out the invention when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

FIGURE 1 illustrates a convergent discount engine made in accordance with the present invention utilizing a rule-based approach for managing information and rendering discounts;

FIGURE 2 depicts the interaction of data accumulation engine tables and their dependencies;

FIGURE 3 depicts the evaluation path for a compound evaluation by the discount engine;

5   FIGURE 4 illustrates the inter relations of the rules router and the application and qualification evaluations performed by the discount engine;

FIGURE 5 illustrates a data model for the convergent discount engine of the present invention;

FIGURE 6 illustrates logical process flow for a convergent billing
10   performed in accordance with the present invention using a rule-based engine;

FIGURE 7 is a block diagram illustrating a system of the present invention using a rule-based system to render discounts by processing customer records;

FIGURE 8 is a block diagram illustrating a method of the present
15   invention utilizing a rule-based accumulation engine and a rule-based discount engine; and

FIGURE 9 is an exemplary computer capable of reading storage media, with exemplary computer readable storage media also being illustrated.

BEST MODE FOR CARRYING OUT THE INVENTION

20   With reference to Figure 1, the high level block diagram of a system of the present invention is generally indicated at 10. As shown, the overall rule-based billing calculation is shown at convergent driver process 12. Convergent driver process 12 is composed of accumulator driver process 14 and discount driver

process 30. Of course, it is appreciated by those skilled in the art that embodiments of the present invention may be implemented in a variety of different ways at the low level, and that the high level diagram shown in Figure 1 is arranged to facilitate an understanding of the present invention. That is, record processing in accordance

5   with the present invention uses a rule-based system. The rule-based system may be formed in a variety of ways, such as with essentially separate accumulator driver and discount driver processes. In the alternative, the accumulator driver process or engine and the discount processor engine may be formed as parts of a larger engine, such as an overall convergent driver processor engine.

10   Accumulator driver process 14 includes account information gathering process 16 and data gathering process 18, in addition to accumulator posting process 20. Account information and other data, such as data representing telecommunication services, are received as data records at data record process 22. These data records are processed by the accumulator engine at accumulator rule

15   process 24. Processing includes target accumulator calculation process 26 and optionally includes tiered product processing 28.

Discount driver process 30 includes discount qualification process 32, discount calculation process 34, and discount posting process 36. Qualification and calculation are controlled by the rule router 38. Rule router 38, based on

20   information in target accumulators, calls on simple qualification rule evaluation process 40, compound rule evaluation process 42, simple application rule process 44, and compound application rule process 46 to process the data and render discounts which are posted at discount posting process 36.

With reference to Figures 1 and 2, the accumulation side of the system will be described in further detail. A suitable application for embodiments of the

25   present invention is in processing billing information in the telecommunications industries. As such, the examples used herein to illustrate the present invention are telephone billing records. However, embodiments of the present invention may be used in a number of different applications, and the rule-based information processing

techniques of the present invention are not necessarily limited to the telecommunications industry.

As shown in Figure 2, an accumulator engine 60, in one suitable implementation, receives data in any format at block 62. That is, data records may contain information in any way because source fields within block 62 are assigned logical names at block 64. As such, the reformatted record of block 64 is processed by the accumulation engine. The reformatted record may be one of any number of different record types. When a customer record is received, an accumulator rules table 70 directs the engine to perform appropriate processing. One way for processing a record with the accumulation engine is to perform a sequence of operations to the data, as shown at accumulator criteria identifier block 72. At block 72, a target accumulator is determined. At block 74, a table interprets the target accumulator determined at block 72 and sends appropriate values to the target accumulators which are indicated at block 76. Although there are many techniques for the implementation of the accumulator engine at the lower level, some examples are given below. In the below reproduced tables, table "ACCRU10T" is rules table 70, table "ACCCR10T" is criteria rules block 72, table "ACCGP10T" is the group name map block 74. Target accumulators 76 are not reproduced in a table format herein.

Accumulation Examples

1668
USW 0535 PUS
Customer No. 22193

ACCRU10T

Region	Rec Id	Source Field	Accmr-Rle-Nme	Accmr-Nme	Accmr-Sto_Seq_No	Function-Name	Ruls-Eff-Dat	Ruls-Dscntn-Dat	Lst-Updt-Dat
C	210	Call-Dur	R0000001				998-02-2	2099-12-31	1998-02-23
C	210	Msg-Chrg-Amt-Tot	R0000002				998-02-2	2099-12-31	1998-02-23
C	220	Call-Dur	R0000003				998-02-2	2099-12-31	1998-02-23
C	220	Msg-Chrg-Amt-Tot	R0000004				998-02-2	2099-12-31	1998-02-23
C	E810101M	BMD81-CHG	R0000005				998-02-2	2099-12-31	1998-02-23
C	E810101M	BMD81-BLBL-TM	R0000006				998-02-2	2099-12-31	1998-02-23
C	B61	CRB-B61-LSJRC				Tier_Prc	998-02-2	2099-12-31	1998-02-23
C	EI	UF-EI-CLSER		TYPSRV	85		998-02-2	2099-12-31	1998-02-23
C	EG	Tot-Curr-Amt-Excl-Tax	R0000007				998-02-2	2099-12-31	1998-02-23

ACCCR10T

Accmr-Rle-Nme	Criteria-Id	Data-Field	Operation	Value Type	Value	True Compare	False Compare	True-Accmr Gr-Id	False-Accmr-Gr-Id	Comment
R0000001	001	ENTY-CD	=	Char	MTN	003	002			Regulated?
	002	ENTY-CD	=	Char	MTT	003	101			
	003	MSG-TYP	=	Char	1			1	2	Direct Dialed?
	101	ENTY-CD	=	Char	MBU	103	102			Unregulated?
	102	ENTY-CD	=	Char	MTU	103	201			Error if No
	103	MSG-TYP	=	Char	1			3	4	Direct Dialed?
	201	ENTY-CD	=	Char	MTW			22	9999	LD USWC feed?
R0000002	001	ENTY-CD	=	Char	MTN	003	002			Regulated?
	002	ENTY-CD	=	Char	MTT	003	101			
	003	MSG-TYP	=	Char	1			5	6	Direct Dialed?
	101	ENTY-CD	=	Char	MBU	103	102			Unregulated?
	102	ENTY-CD	=	Char	MTU	103			9999	Error if No
	103	MSG-TYP	=	Char	1			7	8	Direct Dialed?
	201	ENTY-CD	=	Char	MTW			23	9999	LD USWC feed?
R0000003	001	ENTY-CD	=	Char	MTN	003	002	9		Regulated?
	002	ENTY-CD	=	Char	MTT	003	101	9		

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Accumulation Examples

Group	ID	Field	Op	Type	Value					Description
	101	ENTY-CD	=	Char	MBU		102	10		Unregulated?
	102	ENTY-CD	=	Char	MTU			10	9999	Error if No
R0000004	001	ENTY-CD	=	Char	MTN		002	11		Regulated?
	002	ENTY-CD	=	Char	MTT		101	11		
	101	ENTY-CD	=	Char	MBU		102	12		Unregulated?
	102	ENTY-CD	=	Char	MTU			12	9999	Error if No
R0000005	001	SPLR-ID	=	Char	0551		002.	13		Wireless?
	002	SPLR-ID	=	Char	0718	003			9999	LD?
	003	MSG-TYP	=	Char	1	004	005			Direct Dialed?
	004	RCD-ID-TYP	=	Char	05			26	15	Toll Free?
	005	MSG-TYP	=	Char	3	006	007			Calling Card?
	006	RCD-ID-TYP	=	Char	05			16	27	Toll Free?
	007	RCD-ID-TYP	=	Char	05			28	17	Toll Free?
R0000006	001	SPLR-ID	=	Char	0551		002	18		Wireless?
	002	SPLR-ID	=	Char	0718	003			9999	LD?
	003	MSG-TYP	=	Char	1	004	005			Direct Dialed?
	004	RCD-ID-TYP	=	Char	05			29	19	Toll Free?
	005	MSG-TYP	=	Char	3	006	007			Calling Card?
	006	RCD-ID-TYP	=	Char	05			30	20	Toll Free?
	007	RCD-ID-TYP	=	Char	05			14	21	Toll Free?
R0000007	001	ENTY-CD	=	Char	MTN		002	24		Regulated?
	002	ENTY-CD	=	Char	MTT		101	24		
	101	ENTY-CD	=	Char	MBU		102	25		
	102	ENTY-CD	=	Char	MTU		NULL	25		Unregulated?

ACCGP10T

Accumulator-Gr-Id	Accumulator-Name	
1	MOUUWIAR	MOU Reg

#	Code	Description
2	MOUUWDDR	MOU Reg - Direct Dialed
	MOUUWIAR	MOU Reg
3	MOUUWIAU	MOU Unreg
	MOUUWDDU	MOU Unreg - Direct Dialed
4	MOUUWIAU	MOU Unreg
5	REVUWIAR	REV Reg
	REVUWDDR	REV Reg - Direct Dialed
6	REVUWIAR	REV Reg
7	REVUWIAU	REV Unreg
	REVUWDDU	REV Unreg - Direct Dialed
8	REVUWIAU	REV Unreg
9	MOUUWCCR	MOU Calling Card Reg
10	MOUUWCCU	MOU Calling Card Unreg
11	REVUWCCR	REV Calling Card Reg
12	REVUWCCU	REV Calling Card Unreg
13	REVPCDAT	PCS Airtime Rev
14	MOUULDDT	LD - Tot Usage MOU
	MSGULDDT	LD Tot Msg Count
	MOUULDTF	LD - Toll Free MOU
15	REVULDDD	LD -Direct Dialed Rev
	REVULDDT	LD - Tot Usage Rev

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Accumulation Examples

16	REVULDCC	LD - Calling Card Rev
	REVULDDT	LD - Tot Usage Rev
	REVULDTF	LD - Toll Free Rev
17	REVULDDT	LD - Tot Usage Rev
18	MOUPCSAT	PCS Airtime MOU
19	MOUULDDD	LD -Direct Dialed MOU
	MSGULDDT	LD Tot Msg Count
	MOUULDDT	LD - Tot Usage MOU
20	MOUULDCC	LD - Calling Card MOU
	MSGULDDT	LD Tot Msg Count
	MOUULDDT	LD - Tot Usage MOU
21	MOUULDDT	LD - Tot Usage MOU
	MSGULDDT	LD Tot Msg Count
22	MOUPCDLD	LD USWC feed MOU
23	REVPCSLD	LD USWC feed REV
24	REVUSWC	USWC REV
	REVUSWCR	USWC Reg REV
25	REVUSWC	USWC REV

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Accumulation Examples

No.	Code	Description
	REVUSWCU	USWC Unreg REV
26	REVULDDD	LD -Direct Dialed Rev
	REVULDTF	LD - Toll Free Rev
	REVULDDT	LD - Tot Usage Rev
27	REVULDTF	LD - Toll Free Rev
	REVULDDT	LD - Tot Usage Rev
28	REVULDDT	LD - Tot Usage Rev
29	MOUULDDD	LD -Direct Dialed MOU
	MSGULDDT	LD Tot Msg Count
	MOUULDDT	LD - Tot Usage MOU
	MOUULDTF	LD - Toll Free MOU
30	MOUULDCC	LD - Calling Card MOU
	MSGULDDT	LD Tot Msg Count
	MOUULDDT	LD - Tot Usage MOU
	MOUULDTF	LD - Toll Free MOU

Accumulation Examples

The following examples make reference to the above tables, and the critical table portions are reproduced again, below. Also, refer to the later listed record layouts for the values used in the accumulation examples below. The tables CDFLS10T (block 62) and CDEFS10T (block 64) house the logical names and displacements per record per region. These tables make this process unique in the fact a logical name is assigned to a source field. The logical name can be attached to any field within a given record across the REGION with the same meaning or content. The accumulation criteria table thus can use logical names when building its criteria and does not care about the physical aspect. The join with the CDEFS10T table allow attaching the displacements into a unique record with the given logical name. This process allows for great flexibility, enhances performance, allows table updates rather than source code changes, and is a great improvement over existing systems.

Following are some simple examples showing the accumulation process:

EXAMPLE 1:

Region: C (central region)

Input Record: 210 (Direct Dialed call detail record

Step 1:

The first two rows on ACCRU10T (block 70) are applicable for a 210 record in region C. Row 1 refers to field CALL-DUR (call duration) and points to accumulation rule R0000001.

Region	Rec Id	Source Field	Accmr-Rle-Nme	Accum r-Nme	Accmr-Sto_Seq _No	Function-Name	Ruls-Eff-Dat	Ruls-Dscntn-Dat	Lst-Updt-Dat
C	210	Call-Dur	R0000001				1998-02-23	2099-12-31	1998-02-23
C	210	Msg-Chrg-Amt-Tot	R0000002				1998-02-23	2099-12-31	1998-02-23

Step 2:

. Table ACCCR10T is accessed for all criteria ids with a rule equal to R0000001.

ENTY-CD = MTT

MSG-TYP = 1

5   Process:

Criteria id 001 is false, take the false compare and point to criteria id 002.

Criteria id 002 is true, take true compare and point to criteria id 003.

Criteria id 003 is true, and since no next criteria id, **accumulation answer is group 1**.

10

Criteria-Id	Data-Field	Operation	Value Type	Value	True Compare	False Compare	True-Accmr-Gr-Id	False-Accmr-Gr-Id
001	ENTY-CD	=	Char	MTN	003	002		
002	ENTY-CD	=	Char	MTT	003	101		
003	MSG-TYP	=	Char	1			1	2
101	ENTY-CD	=	Char	MBU	103	102		
102	ENTY-CD	=	Char	MTU	103	201		
103	MSG-TYP	=	Char	1			3	4
201	ENTY-CD	=	Char	MTW			22	9999

Step 3:

20   Accumulate CALL-DUR into group id 1 (ACCGP10T) list of accumulation fields. Accumulate by rules on TARAC10T (target accumulators).

Accumulator-Gr-Id	Accumulator-Name	
1	MOUUWIAR	MOU Reg
	MOUUWDDR	MOU Reg - Direct Dialed

25   Step 4:

Go to step 1 and repeat for all rules present on ACCRU10T.

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210 record layout

---- FIELD LEVEL/NAME -------	PICTURE- ----	
05 CVB-INPT-DA SYNC	GROUP	
10 COM-FIX-FLD-GRP SYNC	GROUP	
5 15 ST-CD-ADMIN	X	2
15 BLG-NPA	999	303
15 BLG-C-O-CD	999	451
15 BLG-LINE-NUMB	9(4)	1329
15 CUST-CD	999	298
10 15 IND-SPEC-ACCT	X	
15 PRSBSCRTN-ID	X	
15 ACC-CUST-NM-ABBR	**XXX**	**MTT** **(ENTY-CD)**
15 FILLER	X	
15 APRNT-BLG-NUMB-NPA	999	0
15 15 APRNT-BLG-NUMB-C-O	999	0
15 APRNT-BLG-LINE-NUMB	9(4)	0
15 ACCOUNT-CODE	S9(5)	0
15 REC-TYPE	**999**	**210**
15 SEQ-NUMB	XX	
20 15 IND-MS-MO	9	0
15 MSG-DATE-SIR SYNC	GROUP	
20 YR-ID	9(4)	1998
20 MO-ID	99	12
20 DAY-ID	99	19
25 15 CONN-TM SYNC	GROUP	
20 HR-CONN	99	7
20 MN-CONN	99	0
20 SEC-CONN	99	0
15 IND-MS-SUM-BND	X	
30 10 LATA-CD	9	1
10 MSG-CHRG-GRSS-AMT	S9(7)V99	9.77
10 MSG-CHRG-GRSS-AMT-JNL-CD	S999	0
10 ACCT-TYPE	S999	0

	10 IND-RSV	9	1
	10 IND-PAGE-BRK	9	0
	10 IND-SPEC-CHAR	9	0
	10 IND-MULT-RATE	9	0
5	10 IND-OVS-CALL	9	0
	10 IND-MULT-LINE	9	0
	10 IND-DIAL	9	0
	10 IND-SPEC-HNDL	9	0
	10 MSG-OTR-LN-CHRG-AMT	S9(7)V99	0
10	10 MSG-OTR-LN-CHRG-AMT-JNL-CD		
		S999	0
	10 FR-OVS-PT SYNC	GROUP	
	15 CITY	X(8)	BRMFLD
	15 ST	XX	CO
15	10 FR-NUMB-GRP-SIR SYNC	GROUP	
	15 NPA-LOC	999	303
	15 C-O-PREFIX	999	451
	15 ACCT-LINE-NUMB	9(4)	1329
	15 OVFL-DIG	99	X'4040'
20	10 TO-OVS-PT SYNC	GROUP	
	15 CITY	X(12)	ERIE
	15 ST	XX	CO
	10 TO-NUMB-GRP-SIR SYNC	GROUP	
	15 NPA-LOC	999	303
25	15 C-O-PREFIX	999	828
	15 ACCT-LINE-NUMB	9(4)	6096
	15 OVFL-DIG	99	X'4040'
	10 IC-CAL-CD-NUMB	S9(10)	0
	10 SETTLE-CD	X	8
30	**10 MSG-TYPE-CD**	X	1	(MSG-TYP)
	10 RATE-CL	X	B
	10 CR-TYPE	X	
	10 IND-MISC-COL	X	+

	Field	SYNC	GROUP
	10 SER-NUMB	X(10)	
	10 CALL-DUR	**SYNC**	**GROUP**
	15 ELPS-MN	**9(5)**	**150**
	15 MN-10THS	**X**	**0**
5	10 FOR-ST-TAX	S9(7)V99	0
	10 MSG-FOR-ST-TX-JNL-CD	S999	0
	10 IC-TAX	S9(7)V99	0
	10 IC-JRNLCD	S999	0
	10 ITEM-NUMB-REF	S999	0
10	10 MSG-CHRG-NET-AMT	S9(7)V99	9.77
	10 MSG-CHRG-NET-AMT-JNL-CD	S99	297
	10 MSG-DSCNTD-CRDT-AMT	S9(7)V99	0
	10 MSG-DSCNTD-CRDT-AMT-JNL-CD		
		S999	0
15	10 VOL-DSCNT-GRSS-AMT	S9(7)V99	0
	10 VOL-DSCNT-GRSS-AMT-JNL-CD		
		S999	0
	10 VOL-DSCNT-NET-AMT	S9(7)V99	0
	10 VOL-DSCNT-NET-AMT-JNL-CD	S999	0
20	10 VOL-DSCNTD-CRDT-AMT	S9(7)V99	0
	10 VOL-DSCNTD-CRDT-AMT-JNL-CD		
		S999	0
	10 MSG-TXBLTY-INDCTN-CD	X	0
	10 ACC-PROD-SPLR-INTRNL-ID	X(7)	
25	10 PROD-SPLR-INTRNL-ID	X(7)	CRDSVCN
	10 ALT-OPR-SVC-ID	X(5)	00000
	10 PRSNL-IDNTFCTN-NO-NM	X(8)	
	10 MSG-CHRG-PRT-AMT	S9(7)V99	9.77
	10 MSG-OTR-LN-CHRG-PRT-AMT	S9(7)V99	0
30	10 FILLER	X	X'00'
	10 IND-SPL-BILL-FRMT-CD	X	
	10 USG-INTRNL-SER-ID	X(20)	

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	10 USG-INTRNL-SEQ-NO	9(4)	1
	10 RCD-REVN-CD	X	7
	10 BLG-PROD-INTRNL-ID	X(5)	
	10 SRV-MARK-CD	X	
5	10 INCL-IN-SUBTOT	X	Y
	10 TYP-OF-REGLTN-CD	9	0
	10 VOL-DSCNT-PRMTN-GRSS-JNL-CD	X	0
	10 VOL-DSCNT-PRMTN-NET-JNL-CD	X	2
	10 VOL-DSCNT-PRMTN-DSCNT-JNL-CD	X	0
10	10 CARR-ID	9(04)	0
	10 SURCHRG-APPLCBL-CD	X	
	10 TYP-OF-CRDT-CD	9	0
	10 RCD-IDNTFCTN SYNC GROUP		
	15 RCD-IDNTFCTN-CAT-CD	99	1
15	15 RCD-IDNTFCTN-GR-CD	99	1
	15 RCD-IDNTFCTN-TYP	99	1
	10 SRV-TEXT-CD	X(5)	00000
	10 MISC-TEXT-CD REDEFINES SRV-TEXT-CD		
	10 MISC-TEXT-CD	X(5)	00000
20	10 SRV-TEXT-CD-INDR	9	0
	10 TO-LOCN-PHRS-INDR	9	0
	10 APPLCN-USG-CD	X	
	10 PRT-GRSS-NET-CD	X	
	10 FR-NO-LNGTH	99	X'4040'
25	10 TO-NO-LNGTH	99	X'4040'
	10 TOT-MSG-CHRG	**S9(7)V99**	**.9.77**

EXAMPLE 2:

Region: C (central region)

Input Record: B61 (Monthly service USOC record)

This process shows how a FUNCTION name can be used in the ACCRU10T (block 70) table to show another way to accumulate data.

Step 1:

The following row on ACCRU10T (block 70) is applicable for a B61 record in region C.   This row is accumulating the usoc charge stored in CRB-B61-LSJRC. The Accumulation Engine recognizes that the function name is populated and calls that function dynamically.   ·

This particular function was built specifically for usoc product records. It accumulates the specific usoc based on an entry in the Tiered product table (TIGLP11V; see below). It can accumulate the money only, keep track of the "count" of usocs of that kind, or both. The accumulation is controlled in this case by this function call. The proper logical names are used in the source code to extract the correct fields off of the input record.

Region	Rec Id	Source Field	Accmr-Rle-Nme	Accumr-Nme	Accmr-Sto_Seq_No	Function-Name	Ruls-Eff-Dat	Ruls-Dscntn-Dat	Lst-Updt-Dat
·C	B61	CRB-B61-LSJRC				Tier-Pr	1998-02-23	2099-12-31	1998-02-23

B61 record:

```
05 CVB-INPT-DA SYNC          GROUP
  10 CRB-B61-TCUST SYNC       GROUP
    15 CRB-B61-TSTST          X             K
    15 CRB-B61-CUSID SYNC     GROUP
      20 CRB-B61-NPA          XXX           303
      20 CRB-B61-CLCS SYNC    GROUP
        25 CRB-B61-PHNO SYNC  GROUP
          30 CRB-B61-CO       XXX           233
          30 CRB-B61-LINE     X(4)          9254
        25 CRB-B61-CUSCD      XXX           544
```

```
         25 CRB-B61-SORT              X
         10 CRB-B61-RECTY             XXX           61B    (RECORD TYPE)
         10 CRB-B61-JEI                      X
         10 CRB-B61-DAEFF             XXX           X'981230'
  5      10 CRB-B61-TRMCD             X(4)          3600
         10 CRB-B61-TXLCD             XX
         10 CRB-B61-TXEXF             X             X'80'
         10 CRB-B61-TXEXS REDEFINES CRB-B61-TXEXF
         10 CRB-B61-TXEXS             X             X'80'
  10     10 CRB-B61-TXEXC REDEFINES CRB-B61-TXEXF
         10 CRB-B61-TXEXC             X             X'80'
         10 CRB-B61-TXEXL REDEFINES CRB-B61-TXEXF
         10 CRB-B61-TXEXL             X             X'80'
         10 CRB-B61-G REDEFINES CRB-B61-TXEXF
  15     10 CRB-B61-G                 X             X'80'
         10 CRB-B61-JRLCD             S999          421    (JOURNAL-CODE)
         10 CRB-B61-TX911             X             1
         10 CRB-B61-LL-SURCHARGE-IND  X
         10 CRB-B61-PKG               X
  20     10 CRB-B61-FLRA              XX
         10 CRB-B61-LSJRC             S9(9)         1699   (CHRG-AMT)
         10 CRB-B61-QUAN              S9(4)         1
         10 CRB-B61-FLRB              XX
         10 ACC-CUST-NM-ABBR-GR       SYNC  GROUP
  25      15 ACC-CUST-NM-ABBR         XXX           MTN    (ENTY-CD)
          15 FILLER                   X
         10 UNIV-SRV-ORD-CD           X(5)          FQTX4  (USOC)
         10 FILLER                    X(4)
```

Example TIGLPL11V for tiered processing

```
  30     TIERED_GR_PLN_ID TRD_GR_ACCUM_CD UNIV_SRV_ORD_CD
                0     COUNT         IFR
```

1	BOTH	RVM
1	BOTH	FQTX4
2	MON	1L5XD
3	BOTH	RAM
4	BOTH	C6BZ4
5	BOTH	CU
6	BOTH	BUFS

EXAMPLE 3:

Region: C (central region)

Input Record: EI (Account master record)

This process shows how an ACCUMULATOR name can be used to accumulate a given field DIRECTLY from the rules table. This is a third way, and very efficient way, to state what needs to be accumulated off of a given record. When the accumr name is populated, the Accumulation engine goes directly to the structure saved internal to the program and makes an update. In this case the accumulator name is TYPSRV and the value stored in UF-EI-CLSER is accumulated based on rules on the target accumulator table.

Region	Rec Id	Source Field	Accmr-Rle-Nme	Accumr-Nme	Accmr-Sto_Seq_No	Function-Name	Ruls-Eff-Dat	Ruls-Dscntn-Dat	Lst-Updt-Dat
C	EI	UF-EI-CLSER		TYPSRV	85		1998-02-23	2099-12-31	1998-02-23

With reference to Figures 3 and 4, the discount engine performs recursive processing to apply rules by traversing a tree structure, generally indicated at 100 in Figure 3. For example, compound rule 102 is to be evaluated. Rule 102 is formed by compound rule 104 and simple rule 106. Rule 104 is formed by rule 108, rule 110, and rule 112. Rule 112 is formed by rules 114 and 116. When performing the recursive (tree-like) evaluation of complex rule 102, the rule evaluation path is as depicted in block 118. As best shown in

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Figure 4, the rule router 132 makes process calls as necessary to apply the rules. To perform qualification evaluations and application evaluations as illustrated in Figure 3, rule router 132 of Figure 4 calls simple application evaluation process 134, simple qualification evaluation process 136, compound application evaluation process 138, and compound qualification evaluation process 140.

Rules Tree & Evaluation Preferred Embodiment (Figure 3):

The CDE Discount Rules evaluation process will walk a tree structure, interpreting the compound and simple rules contained within the tree. One or more simple rules make up a compound rule. The simple rules can be grouped together with =, <, >, < =, > =, < >, (),)(logical operands. Compound rules are grouped together with AND & OR conditions. The process will use the Rule Router to control invocation of Simple and Compound Rules Evaluation, with recursive calls in the compound area. The Rule Router acts as a traffic cop in the interpretation of rules. Each Compound rule will either point to another Compound rule or to a Simple rule. The Simple rules ask the business questions that will be associated with a discount plan(e.g. Customer has more than $100.00 in Local Service). In order for the tree structure to be complete, the tree must end with Simple rules(the legs of the tree may not end in Compound rules). The rules evaluation process within the CDE will walk the tree structures from left to right. Each leg of the tree will be interpreted. The CDE will follow the path of walking down to the lowest level and then working its way back up to the top tree structure. The rules evaluation process will always be aware of the AND & OR conditions trying to be satisfied in the Compound rules. Should a simple rule evaluate False and the combined condition in the Compound rule require True, the rules evaluation process will stop and go up to the next level as the lower process result has already been determined.

Rule Router Preferred Embodiment (Figure 4):

The Rule Router is unique to rules processing. Most rules evaluation processes simply invoke the rules evaluation(Simple or Compound rule)routines and then return a result. With the complexity in the CDE

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requirements, the Rule Router allows us to generate complex tree conditions to meet the needs of the business. Asking many questions about an account in order to render a discount, and have those questions grouped together and dependant on one another. The tree conditions may go to an unlimited depth (only limited

5   by business requirements).

With reference to Figure 5, a data model for the convergent discount engine of the present invention is generally indicated at 160. Model 160 includes various components that make up the accumulation engine and the discount engine. The blocks of model 160 are defined below.

10   **Definitions:**

Disc_Qual_Rules (162)   Discount Qualification Rules – Linked to Discount Plans, States which rule to invoke.

Cust_Subscribed_Plan (164)   Table which contains the discounts plans
15   customers have Subscribed to.

Mult_Disc_Applic_Ref (166)   Details how discount plan interact with one another and who has priority.

Disc_Plan_Activity (168)   Details the customer, the discount plan id rendered and the amount of the discount.

20   Cust_Loyalty (170)   Details the customer and the loyalty points accumulated for that customer.

Disc_Qual_Smpl_Rules (172)   Discount Qualification Simple Rules table.

Disc_Qual_Cmpnd_Rules (174)   Discount Qualification Compound Rules table.

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Disc_Inter (176)

Discount Interaction – relates to Multi_Disc_Applic_Ref.

Disc_Plans (178)

Current and Past Discount Plans along with their effective Dates.

5   Cust_Loyalty_Txn (180)

Customer Loyalty Points transactions.

Accum_Rules (182)

Accumulation Rules table.

Accumulator Group (184)

Accumulator Group table.

Target Accumulators (186)

Target Accumulators – Current accumulators.

10   Disc_Applic_Smpl_Rules (188)

Discount Application Simple Rules table.

Disc_Applic_Cmpnd_Rules (190)

Discount Application Compound Rules table.

Jrnl_Code_Ref (192)

Journal Code Reference table – used for booking of money.

Accumulator_Criteria (194)

Accumulator Criteria table – listing criteria

15

to determine if to accumulate data.

Accum_History (196)

Accumulator history – houses all accumulated data for all customers.

Encode_Decode (198)

Translation table.

Migration_Plan (200)

Details when migration plans where sent to

20

production.

Coupon_Info (202)   Details electronic coupons available for
                                     inclusion in Discount plans.

Disc_Pln_Jrnl (204)   Details the relationship of discount plans to
                                     journal codes.

5   As shown in Figure 6, the logical process flow of a suitable
implementation of the present invention is generally indicated at 220. The logical
process flow of Figure 6 and the data model of Figure 5 may be viewed together
to obtain an understanding of the general process followed in a preferred
implementation of the present invention, and the underlying data model used
10   therewith. As shown in Figure 6, input data along arrow 222 may take any form
because source fields in the records are mapped to logical names for processing
by convergent driver 226. Similarly, output data 224 may be presented in any
format desired. Convergent driver 226, in the exemplary implementation,
performs data accumulation according to accumulator tables 228 and post
15   controls 230. Accumulator driver 232 processes account information 234 and
data records 236. The processing of the data records is performed as previously
described, at process 240.

           As mentioned previously, a rules table implementation may
provide several different ways of processing a data record such as rule criteria
20   base processing 242, tiered product processing 244, or direct placement into a
tiered accumulator 246. On the other side of convergent driver 226 is the
discount engine with the flow beginning at discount request 250. At 252,
discount qualification takes place, with a list of potential plans being generated
at 254 and qualification rules being applied at 256. Discounts are calulcated or
25   rendered at 260 by applying application rules 262 as described previously.
Thereafter, any discount limits are applied at 264, and journal entries are
calculated at 266.

           Although a particular implementation of the present invention has
been described, along with preferred features for the rule-based system such as

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the use of a straight-through accumulator engine and a recursive discount rendering engine, embodiments of the present invention may be implemented in a variety of different ways other than that specific example described above. As best shown in Figure 7, a system of the present invention is generally indicated at 300. In the broad representation of the present invention shown in Figure 7, customer records are received in any format at 310, preferably, with logical names being assigned to source fields. A rule-based system 312 processes the data. In a preferred implementation, the rule-based system includes a discount rules evaluation engine and a data accumulation rules engine. Of course, in some implementations, all of the functions may not be performed by the rule-based system. Preferably, a combination of percentage, flat, tiered, threshold, waived discounts along with loyalty points and electronic coupons may be processed by rule-based system 312. Thereafter, at block 314, discounted bills are generated. Advantageously, embodiments of the present invention provide the ability to look at differing data across company affiliates (for example, in telecommunications industry implementation, local, wireless, carrier, long distance, etc.), and billing environments, and bring it all together and use it in convergent discounts.

In Figure 8, a preferred method for implementing system 300 is generally indicated at 320. At block 322, customer records are received. At block 324, a rule-based accumulation engine is established. At block 326, records are processed with the accumulation engine to accumulate the data in a plurality of predetermined target accumulators. At block 328, a rule-based discount engine is established. At block 330, the plurality of target accumulators are processed with the discount engine to render discounts applicable to the customer.

It is appreciated, that embodiments of the present invention may be implemented as software in a computer readable storage medium. The computer readable storage medium may take any form. For example, magnetic or optical media may be used to store instructions, executable by a computer for managing information and rendering discounts in accordance with the present invention. As shown in Figure 9, a mainframe is generally indicated at 340.

Control logic within mainframe 340 processes the instructions and data to implement the present invention. The instructions and data may be stored in any type of computer readable media such as a disk array 342 and memory at mainframe 340.

5   It is to be appreciated that the present invention, for the very first time, uses a rule-based system to manage customer information and render billing discounts. Advantageously, a rule-based system greatly expands billing system capabilities compared to existing application specific software packages. The present invention allows a system administrator to dynamically define how to

10   accumulate billed infromation items, apply discount rules (in IF THEN ELSE logic patterns) to generate threshold, tiered, flat, percentage discounts, as well as loyalty points and electronic coupons. The invention provides the capability to combine billed charges from different sources and affiliates, interrogate those charges, and apply discounts based on these charges.

15   In summary, a preferred embodiment for a particular application, which the inventors found to be useful and to be a suitable exemplary implementation, has three main components:

1.   Billed Information/Item Accumulation:

        This portion of the engine is rule-based, allows the business to

20   define what items (facts) they would like to know about a customer and the charges that customer has incurred. Being that it is rule-based and externalized, changes can be quickly made to the type of data to be accumulated. Note - based on the definition of these accumulators, the discount engine gains additional capabilities (*e.g.*, if you define where a customer resides, the engine can calculate

25   geography based discounts, if you define how long a customer has been with the company, the engine can calculate tenure based discounts, etc.)

The accumulator engine portion of CD was developed to be a rule-based engine that was to process many accumulator transactions. These transactions or record identifiers were housed in an accumulator rule table that was to drive the accumulation process. due to the volume of transactions, a method was used to design the internal structures to facilitate quick access to accumulation data and/or criteria. The process that was designed used a concept of an internal storage sequence number that was able to allow the software to directly look up the information and greatly improve performance. Another key component included multiple data displacement tables that allowed us to externalize data displacements in regard to accumulator transactions, which enabled us the ability to respond to a business change more quickly by external table updates versus hard-coded software enhancements.

2.   Discount Qualification

This portion of the engine is also rule-based, it allows the business to define what conditions must be present in order to render a discount. The rules are based on if then else structures so they can be understood by a non-technical individual.

3.   Discount Rendering

This portion of the engine is rule-based as well, it applies the rules for rendering a discount. The rules are based on if then else structures so they can be understood by a non-technical individual.

The following applies to both discount qualification and rendering rules:

Rules are categorized into two parts - simple rules (ability to ask simple questions, X = Y, etc. using +, <, >, < >, = >, (),)(logical operators) and compound rules (ability to group simple rules together using AND & OR logic). Rules processing allows you to define any depth to the simple and compound rules using a modified b-tree structure. The rules engine is

constructed to process each logical leg of the rules tree and then based on evaluated conditions exit the structure or continue processing the remaining leg - this allows for efficient processing.

Overall Concept:

The overall engine concept was constructed to allow the business to quickly act and re-act in an ever changing competitive environment. The engine was designed for maximum flexibility and to allow the business to build their own rules without technical intervention using the technical structures depicted above.

Business Capabilities:

The CDE was designed and has the ability to perform the following: auto qualification of discount plans, subscription based discount plans, bundling and package discounting, location discounting, flat dollar based discounts, percentage based discounts, tiered discounting, tenure discounting, threshold discounting for usage and non-usage items, prepay discounts, average based discounting, accumulated spending discounting, long term (more than one month) discounting, date, day and time of week discounting, geography based discounting, contract discounting, affinity discounting, tethering, customer referral discounting, loyalty point processing, electronic couponing, revenue and financial tracking and management, and journaling of discounts and management of bookings.

While the best mode for carrying out the invention has been described in detail, those familiar with the art to which this invention relates will recognize various alternative designs and embodiments for practicing the invention as defined by the following claims.